

ART. IX.—*The Genera of the Plumulariidae, with  
Observations on Various Australian Hydroids.*

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I.—INTRODUCTION.

THE principal objects of the present paper are, in the first place, to present a general summary of the classification of the Plumulariidae, with suggestions for two or three modifications of the genera; and, secondly, to offer some further observations on a few of the Australian Hydroids, which have been previously described by myself or others. Professor Allman's Report on the "Challenger" Plumulariidae, which contains descriptions of several Australian species, was issued after the "Catalogue of the Australian Hydroid Zoophytes" was in the printer's hands, and although it was not till six months later that I had the last opportunity of correcting and adding to the text of the "Catalogue," I was not then aware of Professor Allman's work having appeared, and was, consequently, unable to adopt any of the new genera proposed therein, or otherwise to avail myself of its valuable assistance. Among the species described as new in the Report, one or two appear to me identical with some of Mr. Busk's, and the new genus and species *Halicornopsis avicularis*, described by me in the Journal of the Microscopical Society of Victoria for 1882, is re-described under the name of *Azygoplon rostratum*. These species, with others which are dealt with in the Report, will be more particularly treated of further on, after the general remarks on the Plumulariidae.

In addition to Professor Allman's work, there have appeared, since the completion of the "Catalogue," a list of localities for Australian Hydroids by Dr. Kirchenpauer, a paper by the same author on Northern Genera and Species of Hydroids, which includes also descriptions of several new Australian species, and Dr. Lendenfeld's series of papers on the Australian Hydromedusæ, in which are included descriptions of a number of new and interesting species, and several

new genera, with a list of all the species previously described, and much valuable information respecting the histology of those which the author has studied. I propose to make some further remarks regarding these works before the conclusion of the present paper.

## II.—CLASSIFICATION OF THE PLUMULARIIDÆ.

In the "Challenger" Report Professor Allman divides the Plumulariidae into two principal sections or sub-families, the *Eleutheroplea* and the *Statoplea*. The first of these corresponds to the genera Plumularia and Antennularia of Mr. Hincks and later authors, with such recent genera as are nearly allied to them; the second consists of the Aglaophenia of Hincks and Kirchenpauer, with some other genera possessing the same general type of trophosome. In the *Eleutheroplea* the lateral sarcothecæ are almost invariably movable, and none of those which surround the hydrotheca are actually attached to it; in the *Statoplea*, on the contrary, the lateral, and generally the anterior sarcothecæ, are in contact with the hydrotheca for at least a part of their length, and none of them are movable. The hydrothecæ in the *Eleutheroplea* are usually more or less cup-shaped, with the margin plain, or occasionally sinuated, but not toothed, and are in most cases set at some distance apart, so that the hydrophyton has a graceful, slender aspect; while those of the *Statoplea* are generally closely set on the hydrocladia (or hydrotheca-bearing ramules), and are furnished with teeth or lobes on the margin. But none of these distinctions can be relied upon invariably, as several *Statopleans* have distant hydrothecæ with smooth margins, while some *Eleutheropleans* have closely-ranked hydrothecæ with sinuated margins, and Professor Allman says that at least one species has the margin distinctly toothed. There appears to be, in fact, no single characteristic to which we can point as invariable. I thought to have found such a distinction in the fact that the supracalycine sarcothecæ of *Statopleans* when present are wholly or partially attached to the hydrotheca, while in the *Eleutheroplea* they are not so attached; but *Halopteris* is perhaps an exception to the latter rule, and in some Plumularians the supracalycine sarcothecæ are entirely wanting. But notwithstanding the difficulty of framing definitions which would be universally applicable, it is in most instances easy to refer a species to

its proper sub-family by its general facies, and by the predominance of the characters of one group over those of the other.

The prevalence in the old genus *Aglaophenia* of special ramuli, armed with nematophores, and serving to protect the gonangia, has long been familiar, and of late years two genera of Hydroids have been made known which combine such gonangial structures with the trophosome of a typical Plumularia. Professor Allman accordingly divides each of the sub-families Eleutheroplea and Statoplea into two minor groups—the Phylactocarpa, which have the gonangia protected by some form of “phylactocarp,” or special ramulus armed with nematophores; and the Gymnocarpa, which are destitute of any such structures. The phylactocarpal ramuli of *Aglaophenia* and its allies are the “nematocladia” of Kirchenpauer.

#### NOTE ON THE INTRATHECAL RIDGE.

With regard to the structure of the hydrotheca in the Plumulariidae, the “Challenger” Report says:—“In almost every case there is present in the hydrotheca of the Statoplea a slightly projecting chitinous ridge, which runs on the inner surface of the walls transversely from behind forwards, but with a more or less oblique direction, and which more or less completely encircles the cavity of the hydrotheca, thus forming an imperfect septum, which divides the hydrotheca into a proximal and a distal portion. This is the intrathecal ridge, which, as just said, is never present in the Eleutheroplea. In some species of Statoplea, what has the appearance of a similar ridge running from before backwards may be seen in the anterior portion of the hydrotheca. This, however, is only the optical expression of a fold in the walls of the hydrotheca.” So far as the Australian Plumulariidae are concerned, however, the condition is just the opposite of that stated in the foregoing extract, and the true intrathecal ridge, or partial septum, is that which runs from before backwards, while the posterior one is generally a mere fold in the walls of the hydrotheca. In the half-dozen species of which *Halicornaria superba* is the type,\* and also in *Aglaophenia Huxleyi* and *A. phoenicea* (both of

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\* In *H. speciosa*, a species of this group figured in the Report on the Gulf Stream Hydroids, the anterior ridge is described by Professor Allman as the “intrathecal ridge.”

which are included in the "Challenger" Report), the anterior intrathecal ridge is very conspicuous, being a true partition extending fully half way through the hydrotheca; and if we look into the aperture of the latter at a proper angle we see that the ridge is, in most cases, even more prominent at the centre than where it joins the walls of the hydrotheca, and that it is often thickened at the edge and crenate. In no Australian species have I seen the posterior ridge so prominent, the only one in which I have found it well developed being *Aglaophenia divaricata*, particularly the variety which I formerly described as *A. M'Coyi*; and none of the ten species of *Halicornaria* included in the "Catalogue" show any trace of it. The posterior ridge, however, though stated to be always wanting in the Eleutheroplea, is really present in a rudimentary form in the stout variety of *Plumularia obliqua* and in *P. filicaulis*, and is well developed in *P. Australis*, and still more in *P. spinulosa*. The anterior ridge is large in *P. producta*, extending half through the hydrotheca. The use of the intrathecal ridge is evidently to form a protective shield, behind which the hydranth can retire; and if we consider its structure and origin it will be sufficiently obvious that whether it springs from the back or from the front of the hydrotheca its nature is essentially the same, and that it originates from a fold or constriction of the hydrothecal wall, which is more or less bent upon itself either towards or away from the hydrocladium, or in both directions alternately. If we take a tubular sac of any flexible substance, and bend it slightly upon itself near the base, we shall make a fold or crease, deepest on the side towards which we bend the sac, and partially encircling it. This represents the slight fold which crosses so many species of *Aglaophenia* near the base, constituting a rudimentary posterior ridge. If we now take the same sac, and bend the other extremity in the opposite direction, we shall have a fold on the opposite side, and nearer the mouth. This is found in many species, and varies from a slight narrowing below the aperture to a deep inflection, according to the degree to which the distal part is recurved. This double curving is well shown in *Aglaophenia longicornis* and in the *Cladocarpus ventricosus* of Allman's Gulf Stream Hydroids. It is but a step further to those forms in which the recurved portion is intimately united to the body of the sac, so that the double plate thus formed becomes an internal partition, as seen in *Aglaophenia*



*Huxleyi* and *A. phœnicea*, and, in a still more advanced stage, in the before-mentioned section of *Halicornaria*.

#### STRUCTURE OF THE STEM AND BRANCHES.

In examining the structure of the hydrocaulus, particularly among the Statoplea, I find that there are two distinct modes of branching, one of which is mainly characteristic of the monosiphonic species, while the other is only possible where there is a compound stem. In the former case the stem and branches are simple jointed tubes, which, when the hydrophyton is large, are of considerable thickness, and the branches spring from the ordinary internodes, behind or between the hydrocladia, or occasionally, in some species, replacing them. In most polysiphonic species, on the other hand, the primary jointed stem is slender (the requisite strength being given by the compound stem, which is only developed as the zoophyte increases in size), and the branches spring, not from the jointed stem, but from the supplementary tubes which grow up in contact with it. For example, in *Aglaophenia longicornis* we find at the back of the original slender jointed stem a stouter secondary tube, and from this spring at regular intervals the alternate pinnately-arranged branches. In such species as this it is evident that the fascicled structure must be developed before the branches can be produced, and is therefore essential to the normal growth of the hydrophyton, but there are species which, in the thick stem and the mode of branching, agree precisely with the typical monosiphonic forms, but which, nevertheless, have the lower part of the stem and branches fascicled; in such cases the adventitious tubes might be absent without affecting the general habit.

As regards the origin of the compound stem, it is obvious that the supplemental tubes are hydrorhizal elements. Monosiphonic species sometimes occur, with a few irregular tubes, which, springing from the hydrorhiza, have attached themselves to the basal part of the stem instead of to a foreign body. In *Halicornopsis avicularis* (as in many Sertularians) the additional tubes are regularly present, and are so numerous as to thicken the stem considerably, while in the typical polysiphonic species they are, as shown above, of still more importance. Keeping in mind the hydrorhizal origin of the polysiphonic stem, we see that in *Aglaophenia longicornis*, for example, every one of the main pinnæ is

equivalent to a separate shoot of such species as *A. parvula*, a fact which is further illustrated by the presence, near the base of the stem in the latter species (and, indeed, in many others), of a long oblique joint similar to that which exists near the base of each pinna in *A. longicornis*. Such a joint is seen in young specimens of *A. divaricata*, and when the supplementary tubes grow up, and branches are produced, each branch has a similar joint. I have not hitherto met with any species with branches springing both from the jointed stem and the added tubes.

## ELEUTHEROPLEA.

### PLUMULARIA, Lamk., modified.

Hydrocladia pinnately arranged; sarcothecæ not attached to the hydrotheca.

Gonangia not provided with phylactocarps.

Lamarck's genus *Plumularia* was originally formed to include the whole of the pinnate Plumularians, and was synonymous with the *Aglaophenia* of Lamouroux. The latter author, however, suggested a subdivision of the genus, which was adopted by McCrady and later authors, and in which the name *Plumularia* was assigned to the Eleuthero-plean species, and *Aglaophenia* to the Statoplean. According to Professor Allman's views the genus should be still further limited, so as to include only those species with all the sarcothecæ movable; and in the "Challenger" Report he proposes a new genus—*Heteroplon*—for a species which has the anterior sarcotheca in the form of a stout fixed spine, curved towards the hydrotheca. This condition of the sarcotheca, however, is common to several of our species, while in others it differs from that of a typical *Plumularia* only in its stouter base and consequent wider area of attachment, which renders it rigid. Every possible degree of variation exists between the long, slender sarcotheca, which is swayed by every motion of the fluid surrounding it, and the short fixed spine of *Heteroplon pluma*; it follows, therefore, that there is no definite line of demarcation between *Heteroplon* and *Plumularia*. Of the species described in the "Catalogue," *P. Ramsayi*, *P. cornuta*, *P. setaceoides*, *P. effusa*, *P. obliqua*, *P. spinulosa*, *P. hyalina*, *P. pulchella*, and probably *P. badia*, have the anterior sarcothecæ per-

fectly movable, and would come under the genus as limited by Professor Allman. *P. obliqua* and the three following species agree in having only a single hydrotheca on each pinna. In *P. delicatula* the anterior sarcothecæ are small, and, though agreeing in all essentials with those of the abovenamed species, seem more rigid, always retaining the same position, at least when dry. In *P. campanula* the supracalycine, as well as the anterior sarcothecæ, are short and stout, and so firmly attached as to prevent any variation of their position. If forcibly pushed aside they instantly assume their normal position on removing the pressure. Notwithstanding the fixed nematophores, this species is described by Professor Allman in the Report as a Plumularia, under the name of *P. laxa*. The other species described in the "Catalogue" which have the anterior sarcotheca immovable, and curved towards the hydrotheca, are *P. Buskii*, *P. aglaophenoides*, *P. Goldsteini*, *P. filicaulis*, *P. compressa*, *P. Australis*, and probably *P. obconica*. *P. compressa* and *P. Australis* agree with *P. obliqua* and its immediate allies in having only one hydrotheca on each pinna, but differ in the stout fixed anterior sarcothecæ, which look like projecting portions of the hydrocaulus. In several of the species the sarcotheca is so strongly curved towards the calycle as to seem almost appressed to it.

It will be seen, therefore, that among the Australian Eleutheroplea the fixed condition of the anterior sarcothecæ is by no means rare, as, according to Professor Allman, it is in the sub-family generally, and that, in fact, it obtains in at least half our species. As it is not constantly associated with any peculiar form of the sarcotheca, but depends merely on its relative size at the point of attachment and the firmness of the perisarc, and does not imply any important structural distinction, it seems best to include all the species under the genus Plumularia—in other words, to continue to take that genus in the sense in which it is used by Hincks, Kirchenpauer, and most other recent writers on the Plumulariidae. I would further suggest that the other Eleutheroplean genera should be made sufficiently comprehensive to include species which differ from each other only in the fixed or movable condition of the anterior sarcothecæ.

#### HALOPTERIS, *Allman*.

Hydrocladia pinnately arranged; mesial sarcothecæ not adnate to the hydrothecæ; laterals fixed, adnate.

Gonangia unknown.

*H. carinata*, the only species, agrees with the typical *Eleutheroplea* in the form and position of the calyces, and the anterior sarcothecæ, though fixed, are attached by a slender base. The supracalycine sarcothecæ are described as adnate to the side of the hydrotheca, which character is unknown elsewhere in the sub-family. In Professor Allman's figures, however, the cup of the sarcotheca is shown raised above the margin of the hydrotheca, and the long tubular adnate portion seems rather to resemble the peduncles which, in several species of *Plumularia*, support the sarcothecæ, than an intimate part of the latter organs.

#### ACANTHELLA, *Allman*.

Hydrocladia pinnately arranged, those near the tips of the branches replaced by spines; sarcothecæ not attached to the hydrotheca.

Gonosome unknown.

The genus *Acanthella* is formed for the single species, *Plumularia effusa* (Busk), and differs from *Plumularia* only in having spines armed with nematophores in place of the hydrothecal ramules towards the extremities of the branches.

#### ANTENNELLA, *Allman*.

Hydrocladia simple, springing directly from the hydro-rhiza; sarcothecæ not attached to the calycle.

Gonangia not provided with phylactocarps.

This genus is distinguished from *Plumularia* by the absence of a stem. In several *Plumularians*, however, simple ramuli like those of *Antennella* have been found growing from the same hydro-rhiza with ordinary pinnate shoots. This has been observed by Busk in *Plumularia campanula*, by Kirchenpauer in *P. filicaulis*, and by myself in *Halicornaria humilis*, and it is quite possible that all the species of *Antennella* may be similar stemless forms of ordinary ramulose species.

#### SCHIZOTRICA, *Allman*.

Hydrocladia pinnately arranged, bifurcating once or more; sarcothecæ not attached to the hydrotheca.

Gonangia not provided with phylactocarps.

The distinguishing feature in this genus is the bifurcation of the pinnae. In both known species there is seated in each bifurcation a hydrotheca without nematophores. One of them is further remarkable for having two sarcothecæ side by side in place of the usual anterior one.

POLYPLUMARIA, Sars, modified.

Hydrocladia pinnately arranged, with an accessory hydrothecal ramulus springing from the proximal internode of each; sarcothecæ not attached to the hydrothecæ.

Gonangia not provided with phylactocarps.

The genus Polyplumaria of Sars was characterised mainly by its doubly pinnate ramification, while Diplopteron (Allman) was distinguished by the same feature, and also by the possession of two pairs of lateral sarcothecæ above the hydrotheca. In the "Challenger" Report the species are united under Polyplumaria, and the generic characters modified, making the essential feature the possession of an accessory ramulus bearing hydrothecæ, and springing from the proximal internode of each pinna. According to Sars' figures, his *Plumularia gracillima* has the same peculiarity, and our *P. cornuta* also has the secondary ramulus, though in an aborted or rudimentary form.

MONOSTÆCHAS, Allman.

Hydrocladia arranged uniseriably; sarcothecæ not attached to the hydrotheca.

Gonangia not provided with phylactocarps.

In the only known species of this genus the hydrocladia are arranged in a single series along the distal side of the branches, somewhat as in the Gymnoblasic genus Pennaria. The minute structure is like that of *Plumularia Catharina*.

ANTENNULARIA, Lamarch.

(*Nemertesia*, Lamouroux.)

Hydrocladia disposed along three or more sides of the stem; sarcothecæ not attached to the hydrothecæ.

Gonangia not provided with phylactocarps.

The hydrocladia of Antennularia have been usually described as verticillate. The above definition will include all the species now known, among which are the *Heteropyxis*



*norvegica* of Sars, in which the hydrocladia are in threes, with a sub-spiral arrangement; the *Nemertesia decussata* of Kirchenpauer, which has the hydrocladia in pairs, each pair being in a plane at right angles to that of the pairs next above and below, so as to form four series on the stem; and the *Antennopsis hippuris* of Allman, in which they are without definite order. Professor Allman now considers *Antennopsis* not distinct from *Antennularia*.

#### SCIURELLA, *Allman*.

Hydrocladia disposed round the stem; sarcothecæ not attached to the hydrotheca.

Gonangia with horn-like processes, and a ramified blastostyle.

The only species known has the hydrocladia arranged as in *Antennularia decussata*, and differs from *Antennularia* only in the gonosome.

The genera already passed in review belong, so far as is known, to the *Gymnocarpa*; the two remaining genera, *Hippurella* and *Callicarpa*, constitute the *Phylactocarpal* section of the *Eleutheroplea*. Each of these genera is at present represented by a single species only; both are from the North American coast, and both are very similar in the minute structure of the trophosome.\*

#### HIPPURELLA, *Allman*.

Trophosome as in *Plumularia*.

Gonangia protected by phylactocarps, which consist of nematocladia arranged verticillately at the tips of the ordinary branches.

Professor Allman described this genus in the Report on the Gulf Stream Hydroids, but supposed the verticillate branchlets to be hydrocladia. Mr. Fewkes, on further examination, found that they were provided with nematophores instead of hydrothecæ, constituting a phylactocarpal gonosome. In the only known species there are six ramuli in each verticil.

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\* In the "Catalogue" I have inadvertently stated that these genera have a similar trophosome to that of *Aglaophenia*.

CALLICARPA, *Fewkes*.

Trophosome as in Plumularia.

Gonangia protected by phylactocarps, which consist of nematocladia, arranged verticillately, and occupying a short distinct branch.

The principal difference between Callicarpa and Hippurella is in the position of the gonosomes, which in the former genus form distinct branches, instead of being the distal portions of the ordinary ones. In the single species which is known the phylactocarps are produced in verticils of three, and each one is twice bifurcated, so as to form four spine-like ramuli, each whorl thus consisting ultimately of twelve ramuli, which curve upwards, the whole gonosome resembling a spike of barley. The close alliance with the preceding genus is obvious, and, as Mr. Fewkes remarks, "it is, morphologically speaking, as if the proximal part of the branch which bears pinnæ in Hippurella was reduced to a peduncle, and the distal end, with its verticillate ribs, became the gonosome."

GATTYA, *Allman*.

Hydrocladia springing directly from the hydrorhiza, or from other hydrocladia, borne on jointed peduncles; hydrothecæ with a toothed margin; lateral sarcothecæ movable.

This genus is peculiar in its habit, the hydrocladia growing directly from the hydrorhiza, or springing irregularly from each other; but in either case the basal part is composed of a number of short joints without appendages, forming a sort of peduncle. The anterior sarcotheca is of the fixed type found in several of our Plumulariæ (which would be included in the genus Heteroplone of Allman), and the toothed calycle is, according to Professor Allman, unknown elsewhere among the Eleutheroplea.

STATOPLEA.

The genus Aglaophenia, as understood by Hincks and Kirchenpauer, included the whole of the Statoplean Plumulariidæ, both Phylactocarpal and Gymnocarpal. Professor Allman separated the species with unprotected gonangia, under the name of Halicornaria, but at first associated with them a species (*H. saccharia*) which has the gonangial ramules slightly modified. I suggested in the

"Catalogue" that such species should rather be associated with those in which the gonangial pinnæ are still further altered, and that only the species with unprotected gonosomes should be included under *Halicornaria*. Professor Allman independently came to the same conclusion, and, in the "Challenger" Report, proposed the genus *Lytocarpus* (an adaptation of Kirchenpauer's sub-genus *Lytocarpia*) for the species which have the gonangia borne on modified pinnæ; but also included in it a section of the corbula-bearing species. This appears to me by no means the most natural arrangement, as will be apparent if we divide the species of *Aglaophenia* and *Lytocarpus* admitted by Professor Allman into three groups, as follows:—

1. A corbula present, the ribs of which form leaflets, and do not bear hydrothecæ (*Aglaophenia*, Allman).

2. A corbula present, the ribs of which bear a single hydrotheca near the base, and do not form leaflets (*Lytocarpus*, Allman, part).

3. No corbula, gonangia borne on scattered modified pinnæ (*Lytocarpus*, Allman, part).

In view of the fact that the first and second of these sections agree in the presence of a corbula—which, moreover, is in each case formed from the same structural elements, only somewhat differently modified—while in the third group the corbula is entirely absent, it seems evident that the first two groups are much more nearly allied to each other than either of them is to the third, and, consequently, if there is to be any generic separation, this group must stand alone. I propose, therefore, to modify the generic description of *Lytocarpus* so as to make it include this section only—that is to say, all the species in which the gonangia are borne on pinnæ, the distal portions of which are modified by the suppression of the hydrothecæ, so as to form nematocladia. It is to be observed that it is not the scattered position of these nematocladia which so sharply distinguishes this section from all the true corbula-bearing species (in fact, the *Lytocarpus racemiferus* of Allman has the nematocladia brought together in a special part of the branch, so as to form what may be called a "pseudo-corbula"); but the fact that the true corbula is composed of nematocladia which are not modified pinnæ, but secondary structures springing from the pinnæ, and not represented at all in the species which I would assign to *Lytocarpus*.

Coming now to the question as to whether the first two of the foregoing groups should be re-united under *Aglaophenia*, or whether the second should be considered a distinct genus, I am strongly inclined to adopt the former course. The distinctions between these two groups, as laid down by Professor Allman, are simply that in the first the corbula-ribs form leaflets, and do not bear hydrothecæ, while in the second they are rod-shaped or sabre-shaped, and have a hydrotheca near the base of each. If these differences were constant they might be deemed of generic importance; but in such species as *A. divaricata* (Busk) and *A. acanthocarpa* (Allman) the ribs are almost filiform, and certainly do not merit the name of leaflets so much as do those of *A. distans* (Allman), which, nevertheless, Professor Allman would now place under *Lytocarpus*, presumably on account of the ribs bearing hydrothecæ; while in *A. vitiana* (Kirchenpauer) we have a species in which the ribs of the corbula assume the form of broad leaflets, like those of *A. pluma* and its allies, except that they are only united to each other at intervals along the margins instead of continuously, and yet bearing each a hydrotheca, as in the species of the other section. Seeing, therefore, the impossibility of drawing any satisfactory line between them, I regard all the true corbula-bearing species as belonging to the genus *Aglaophenia*, the essential character of which will be the possession of a corbula, the ribs of which are secondary structures, springing from a modified pinna, and consisting of the modified mesial nematophores of the hydrothecæ near their base, which hydrothecæ may be either present or suppressed.

The *Lytocarpus secundus* of Allman is a very exceptional species, but if, as Professor Allman supposes, the single series of nematocladia borne by the gonangial pinna be homologous with the ribs of the corbula of *Aglaophenia*, it may be regarded as an aberrant form of that genus. This seems the more likely, from the fact that the spine-like nematocladia are only borne on alternate internodes, as if the whole of one series had been suppressed.

The homology of *Aglaophenia myriophyllum* seems to be in dispute, as Professor Allman says that its corbula consists of ribs formed exactly as in other species by the modification of the mesial nematophores of the hydrothecæ at their base; while Mr. Hincks states that these structures "do not take the place of the anterior sarcotheca, which is present, as

usual, but spring from the stem supporting the calycle between the latter and the sarcotheca;" and he adds that "in some cases after reaching a certain height they give origin to a second calycle similarly placed;" and he consequently concludes that they are modified ramuli, in which case the species would come under the genus *Lytocarpus*, as herein restricted.

AGLAOPHENIA, *Lamouroux*, modified.

Hydrocladia pinnately arranged, mesial and lateral sarcothecæ attached to the hydrotheca for at least a part of their length.

Gonangia produced in a corbula, the rachis of which is a modified hydrocladium, and the ribs modified mesial sarcothecæ, often united to form a closed sac.

According to the above definition the genus will include all the true corbula-bearing species which Professor Allman ranks under *Lytocarpus*. I have taken for granted the correctness of Professor Allman's theory of the origin of the corbula. According to this view the hydrothecæ of the gonangial pinna become, in certain species, turned alternately to the right and the left, and raised above the pinna on peduncles, and it is the mesial sarcothecæ of these hydrothecæ which, becoming enormously enlarged and developing a number of secondary sarcothecæ, constitute the ribs of the corbula. Mr. Fewkes' objection that this view assumes the existence of two series of hydrothecæ side by side on the gonangial pinna is based on a misconception, as the pinna consists only of a single series of internodes with a hydrotheca on each, though the fact of the hydrothecæ being turned alternately to right and left gives them the appearance of being biserial. It is an easy transition to such species as *A. divaricata*, which have the hydrothecæ of the corbula entirely suppressed; and, whether the hydrothecæ be absent or not, the ribs may be represented by broad leaflets, and united to form a pod. Such species as *A. divaricata* have the secondary sarcothecæ of the narrow corbula-ribs in distinct pairs, and usually very much larger than those which border the broad leaflets of *A. parvula* and its allies.

Of the Australian species whose gonosomes are known, those which have an open corbula, with numerous narrow ribs, like those of *A. acanthocarpa* (Allman), are *A. divari-*



*cata*, *A. plumosa*, *A. ramosa*, and *A. formosa*; those which have a closed corbula are *A. parvula*, *A. pluma*, *A. MacGillivrayi*, *A. crucialis*, and *A. Lendenfeldi* (*A. Kirchenpauri*, Lend.)

#### LYTOCARPUS, Allman, modified.

Trophosome as in Aglaophenia.

Gonangia protected by nematocladia, which consist of modified hydrocladia, and do not produce secondary ribs.

There are two Australian species described in the "Catalogue" which will have to be placed under this genus—namely, *A. urens* and *A. phœnicea*. In the former the scattered gonangial pinnæ bear several hydrothecæ below the gonangium, but above it are abbreviated and provided with nematophores only. *A. phœnicea* has every third pinna on each side of the fertile branches altered into a nematocladium, bearing only a single hydrotheca below the gonangium, and having the rest of its length recurved, and armed with two series of large nematophores. In *L. racemiferus* (Allman) the nematocladia are all brought together into a particular part of the branch, forming a pseudo-corbula. In this species each joint of the nematocladium bears three sarcothecæ, the mesials of the suppressed hydrothecæ being retained as well as the laterals.

There is a striking resemblance between the nematocladia of *L. phœniceus* and those of *A. divaricata*. In the "Catalogue" I have cited these species, along with *A. urens*, *A. patula* (K.) and *Pleurocarpa*, as showing the stages in the transition between species with naked gonangia and those with a true corbula; but this seems to be an error, caused by superficial resemblances, since the nematocladia of *L. phœniceus* and its allies are altered pinnæ, while those of *A. divaricata* are modified mesial nematophores, and those of *Pleurocarpa* are, according to Allman, homologically distinct from either.

#### CLADOCARPUS, Allman.

Trophosome as in Aglaophenia.

Gonangia protected by phylactogonia (special protective branches which spring from the hydrocladia).

In all the known species of this genus the phylactogonia spring from the proximal internode of an ordinary hydrocladium, and are curved over the gonangium, which may be

borne on the phylactogonium itself, or on the stem, or in both positions. They do not take the place of the mesial nematophore of the proximal hydrotheca, though in one or two cases these hydrothecæ are destitute of a mesial nematophore; but it is suggested that they may represent the nematophores of hydrothecæ which are suppressed. They are usually, but not always, branched and antler-like.

Several species of *Cladocarpus* are noticeable for being of a more slender and flexuous type than the *Statoplea* generally, and for having much elongated hydrothecæ, with even margins. In one or two species the anterior sarcotheca does not touch the hydrotheca.

#### *AGLAOPHENOPSIS, Fewkes.*

Trophosome as in *Aglaophenia*.

Gonangia protected by special ramuli, each of which is a modification of the mesial sarcotheca of the proximal hydrotheca on a pinna.

The characters relied on by Mr. Fewkes to distinguish this genus from *Cladocarpus* are the unbranched and jointed condition of the phylactocarp; but Professor Allman has described a species of *Cladocarpus* with jointed phylactogonia, and does not consider the branching essential. The phylactocarps of *Aglaophenopsis*, however, are modified from the mesial nematophores of the proximal hydrothecæ, while in *Cladocarpus* they are independent structures, and the genus, if retained, must rest on this distinction.

#### *PLEUROCARPA, Fewkes.*

Trophosome as in *Aglaophenia*.

Corbula formed from part of a branch, of which the other portion bears hydrocladia.

Mr. Fewkes regards the gonosome in this genus as undoubtedly formed from a branch, which seems proved by the presence of the ordinary pinnæ on the distal portion; he also considers it homologous with the corbula of *Aglaophenia*, but this view cannot be correct, as the corbula in that genus is formed from a pinna. The arched ribs forming the corbula are supposed by Professor Allman to represent the phylactogonia of *Cladocarpus*, the pinnæ which in that genus support them being here entirely suppressed. Mr. Fewkes, on the other hand, seems to regard them as altered pinnæ. If the

latter supposition be correct, there is nothing to separate the genus from *Lytocarpus*, one species of which (*L. racemiferus*) has the nematocladia all together in one portion of the branch. The form of the tubular sarcothecæ on the ribs, however, approximates most nearly to that found in some species of *Cladocarpus*, and the fact that they are described as projecting at right angles on all sides of the ribs does not favour the theory that the latter are modified pinnæ, as when this is the case the sarcothecæ are arranged symmetrically in the same median or lateral positions which they would occupy if the hydrothecæ were present. A remarkable feature of *P. ramosa* is the presence on the most proximal part of the fertile branch, where no pinnæ are produced, of a series of hydrothecæ. Professor Allman suggests that they may be nematophores, which have been mistaken for hydrothecæ, and there is no doubt that the structure strikingly resembles in appearance the proximal part of the ordinary branches in such species as *Aglaophenia divaricata*, which are destitute of pinnæ, and bear a central series of large sarcothecæ. I know of no case among the *Statoplea* where hydrothecæ are regularly borne directly on a stem or branch, though I have met with an abnormal instance of such a case.

#### ACANTHOCLADIUM, *Allman*.

Hydrocladia replaced by spines at the tips of the branches; remainder of trophosome and gonosome as in *Aglaophenia*.

This genus is distinguished, like *Acanthella* among the *Eleutheroplea*, by having the pinnæ at and near the tips of the branches in the form of hollow spines, destitute of hydrothecæ. The ribs of the corbula in *A. Huxleyi* are not flattened, and each bears a hydrotheca.

#### PENTANDRA, *Von Lendenfeld*.

Hydrocladia pinnately arranged, a mesial and two pairs of lateral sarcothecæ adnate to each hydrotheca.

Gonosome a corbula, as in *Aglaophenia*.

Two species of this very distinct genus have been described by Dr. von Lendenfeld. The hydrothecæ resemble those of a typical *Aglaophenia*, with tubular mesial and lateral sarcothecæ in the usual positions, but possess, in addition, a second pair of laterals, which are adnate to the sides of the hydrotheca as far as the margin, above which, in both species,

they rise to a considerable height, the free part about equalling the adnate. The mesial sarcothecæ are about as long as the hydrotheca, so that the added pair of laterals are much the longest of the five. Both species have a closed corbula, of the same type as that of *A. pluma*.

#### HALICORNARIA, Busk, modified.

(*Gymnangium*, Hincks.)

Trophosome as in *Aglaophenia*.

Gonangia not protected by phylactocarps.

This genus is now taken to include only those species which are destitute of any form of phylactocarp. It was first proposed by Busk for all the pinnate *Gymnocarpal* Plumularians, but modified by Allman, so as to exclude the *Eleutheroplea*. Hincks, however, had previously proposed the name *Gymnangium* for the group now included under *Halicornaria*, but though the former name had the priority, it has been universally passed over in favour of the latter. All the species of *Halicornaria* described in the "Catalogue" are destitute of folds in the hydrothecal internodes. None of them have any trace of the posterior intrathecal ridge, but in *H. superba* and its allies the anterior ridge is very conspicuous.

Professor Allman's *H. plumosa* should be re-named, as Dr. Armstrong has described a species under the same name.

The *Halicornaria ramulifera* of the "Porcupine" expedition appears to me so distinct by reason of the separation of the mesial nematophores from their hydrothecæ, and the interposition of the accessory ramuli, that a distinct genus ought to be established for its reception. Each internode of the hydrocladia bears one of these appendages, and all of them curve towards the distal end of the pinna, and not backwards over the gonangia.

#### HALICORNOPSIS, Bale.

(*Azygoplon*, Allman.)

Hydrocladia pinnately arranged; a fixed anterior sarcotheca adnate to the hydrotheca, laterals absent.

Gonangia not protected by phylactocarps.

This genus, which was first described by me in the Journal of the Microscopical Society of Victoria for 1882, differs from

Halicornaria simply in the absence of the lateral sarcothecæ. The species on which it is founded, *H. avicularis*, had been previously described by Kirchenpauer under the same specific name, but, as he could not find the lateral sarcothecæ, he described them as minute. The *Azygoplon rostratum* of the "Challenger" Report is the same species.

DIPLOCHEILUS, *Allman*.

Hydrocladia pinnately arranged; hydrothecæ provided with an outer calycine envelope; mesial sarcotheca not adnate to the hydrotheca, laterals absent.

Gonosome unknown.

This genus is distinguished by the duplicature of the hydrotheca-walls. *D. mirabilis*, the only species, has the mesial sarcotheca in the form of a concave disc, with a perforation in the centre. Its affinities are with the Eleuthero-plea quite as much as with the Statoplea.

STREPTOCAULUS, *Allman*.

Hydrocladia uniserial, spirally disposed round the stem; trophosome otherwise as in Aglaophenia.

Gonosome unknown.

This genus is distinguished from all other Statopleans by the spiral and uniserial disposition of the hydrocladia, and is the only genus yet known in the sub-family which has the hydrocladia disposed otherwise than pinnately.

III.—GENERAL NOTES ON AUSTRALIAN HYDROIDS.

CAMPANULARIA RUFA, *Bale*.

This species resembles *Laföea halecioides*, described by Allman in the Report of the "Porcupine" expedition, but may be distinguished by the stem-processes from which spring the hydrothecæ, and which are much thicker than the pedicles of the latter species. There is also a distinct, though narrow, floor to the hydrotheca.

LINEOLARIA FLEXUOSA, *Bale*.

The gonangia of this species, hitherto unknown, may be defined as follows:—



Gonothecæ broadly elliptic, very convex above, with irregular transverse rugæ; aperture rather large, terminal, looking upward; margin elevated and expanding, operculate; a number of long, erect spines (usually somewhat over 20) on the upper side of the gonotheca, about equidistant from each other.

The hydrophyton often commences to grow in a tolerably regular fashion, giving off alternate pinnately-disposed branches, and afterwards forming an irregular network. To the naked eye it resembles very delicate metallic tracery. Most commonly the polypary is more or less invested by minute diatoms and other adventitious matter; but when this is not the case—as in the newly-formed portions—the structure is perfectly clear and transparent, and of such tenuity as to resemble a soap-film. When seen by reflected light it is more or less iridescent.

#### SERTULARIA BISPINOSA, Gray.

It is noticeable that in this species the older portions of the hydrocaulus are decidedly coarser and stouter than the more recently formed distal portions, a condition which I have not observed in the allied species *S. operculata*.

I have omitted to mention that Professor D'Arcy W. Thompson argues in favour of the identity of the two species, and cites Kirchenpauer's *Dynamena fasciculata* (which he considers to be Gray's *D. bispinosa* under another name) to show that there is no more than a varietal difference. This appears, however, to be a misconception, for Kirchenpauer's species is absolutely identical with our common form of *S. operculata*, which differs from the true *S. bispinosa* in having the calyces adnate for the greater part of their length, and in the form of the gonothecæ.

Such specimens as I have seen of *S. bispinosa* may be readily distinguished from *S. operculata* by the touch alone, as its coarser habit and sharper serrulations (caused by the more projecting hydrothecæ) give it a peculiar harshness, which is very characteristic.

Mr. H. Watts has collected this species at Warrnambool.

#### SERTULARIA TRISPINOSA, Coughtrey.

A specimen of this species was collected by Mr. H. Watts at Warrnambool many years since. It has not been recorded from any other Australian locality.

SERTULARIA LOCULOSA, *Busk.*

I have described this species in the "Catalogue" as being occasionally pinnate, but have now no doubt that the supposed pinnate specimens belong to a different species—namely, the *S. Australis* of Kirchenpauer. So far as is known at present, *S. loculosa* has only occurred in the simple form.

SERTULARIA AUSTRALIS, *Kirchenpauer.*

Some specimens of a Sertularian which I received from Mr. Maplestone, and considered a pinnate form of *S. loculosa*, are, I believe, to be referred to the above species. By comparing the figure of a variety of *S. loculosa* which is given in the "Catalogue" (Plate IV., fig. 6) with that of *S. Australis* (Plate VIII., fig. 7), it will be seen that there is no noticeable difference in the form of the hydrothecæ; but specimens of the latter species which I have since collected at Williams-town have hydrothecæ which are almost entirely without the abrupt bend in the middle, and are provided with shorter teeth. The species is evidently a close ally of *S. divergens* and *S. tenuis*, from which it differs mainly in the larger and stouter internodes and hydrothecæ. As in those species, the internodes are comparatively wide below the hydrothecæ, and slender and elongated above, with slender joints. Though the species is usually pinnate, specimens of simple habit are occasionally met with.

SERTULARELLA JOHNSTONI, *Gray, sp.*

Under this name I have included two rather distinct forms—one (from New Zealand) with the hydrothecæ somewhat narrowed towards the aperture, or sub-conical, and with the gonangia narrow in proportion to their length, and with about fourteen annulations; the other, common in Bass' Straits, rather stouter, with tubular hydrothecæ, and the gonangia larger, proportionally broader, and with not more than about eight annulations. Dr. Kirchenpauer considers that in the type form the long, closely-ringed gonangia are associated with completely tubular hydrothecæ, and he describes as a new species (*S. purpurea*) a form which differs little, if at all, from the New Zealand one mentioned above, the free part of the hydrothecæ being, perhaps, slightly shorter. Professor Allman, however, describes the hydrothecæ of *S. Johnstoni* as being slightly narrowed towards the

aperture, and Mr. Coughtrey calls them conical or sub-conical. I have no doubt, therefore, that my New Zealand specimens are the true *S. Johnstoni*. With regard to the Bass' Straits form, its tubular hydrothecæ, and the distinct form of its gonangia, entitle it to rank as a distinct variety, perhaps even as a distinct species. It is stated, however, by Mr. Coughtrey that there is considerable variation among New Zealand specimens, the annulations of the gonangia differing greatly in number and closeness. Hence, I have not felt justified in establishing a new species on what might prove insufficient grounds. The *S. divaricata* of Busk differs from this form to a comparatively small extent, and may have to be united with it, as I have seen specimens which appeared intermediate.

PLUMULARIA CAMPANULA, *Busk*.

The *Plumularia laxa* of Professor Allman ("Challenger" Report) is, I have no doubt, identical with the above species.

PLUMULARIA BUSKII, *Bale*.

I have described this species as having the median sarcothecæ fixed; this applies, however, only to the anterior ones, those above the hydrothecæ being movable.

PLUMULARIA AGLAOPHENOIDES, *Bale*.

It is suggested in the "Catalogue" that if the genus *Diplopteron* be retained, it should be modified so as to include this species. The suggestion, however, is no longer applicable, as the genus has since been merged by Professor Allman in *Polyplumaria*, the essential feature of which, according to the more recent definition, is the possession of an accessory ramulus springing from each pinna.

PLUMULARIA EFFUSA, *Busk*.

This species is the type of Allman's genus *Acanthella*, which is distinguished by the presence of spines or metamorphosed hydrocladia at the distal part of the branches. From the "Challenger" Report it appears that Kirchenpauer's description (which I have quoted in the "Catalogue") is erroneous in assigning only a single supracalycine nematophore to each hydrotheca, there being in reality a pair of laterals, as in the *Eleutheroplea* generally.

Were it not that the "Challenger" specimens have been identified by Mr. Busk and Professor Allman from actual comparison with the original types of *P. effusa*, it would be difficult to believe them the same. The figure in the "Report" represents a strong, coarsely-growing species, with very distinct pinnæ, and calyces conspicuous to the naked eye, as in the larger *Aglaopheniæ*; while Kirchenpauer's figure of *P. effusa* shows a slender form, in which not only are the hydrothecæ far too small to be seen without optical aid, but the hydrocladia themselves are so delicate as to be scarcely noticeable, like a fringe of very fine hairs. That this is the more correct representation is proved by a sketch of Mr. Busk's of a portion of the polypidom, which is precisely like Kirchenpauer's figure, except that the pinnæ are a fraction longer. The magnified figure in the "Report" also differs somewhat from that of Kirchenpauer, and from Mr. Busk's sketches, notably in the hydrothecæ being less ventricose, and in the direction of the folds in the hydrothecal internode. The nematophores are shown by Kirchenpauer as having the margin entire, while in the "Challenger" figure it appears sinuated or canaliculate. Here the inaccuracy is doubtless on Kirchenpauer's part, as all the allied species have canaliculate sarcothecæ; indeed, I have never met with an Eleutheroplean in which the structure was otherwise.

#### PLUMULARIA CORNUTA, *Bale*.

This species might with propriety be placed in the genus *Polyplumaria*, which, as now modified, is distinguished by the presence of an accessory hydrocladium springing from the proximal part of each pinna, although in *P. cornuta* the accessory ramulus bears only a single hydrotheca, above which it terminates in a blunt point.

#### PLUMULARIA WATTSII, n. sp.

Hydrocaulus monosiphonic, branched, attaining a height of about ten inches; stem very slender, almost equal in thickness throughout; branches numerous, small, disposed around the stem in an irregular spiral, about 1-16th of an inch apart, one on each stem-internode, close to the summit; sometimes bearing one or two small secondary branchlets as well as the pinnæ; pinnæ short, alternate, one borne close to the summit of each internode of the branches, divided

into alternate longer and shorter internodes, of which only the former bear hydrothecæ. Hydrothecæ cup-shaped, expanding upward, rather short, adnate up to the margin, aperture at right angles with the pinna. Sarcothecæ bithalamic, canaliculate, slender at the base and movable; one below each hydrotheca, and one at each side above it; one between every two hydrothecæ, on the intermediate internode; one at the base of each pinna, and one on the lower part of each internode of the branches.

Gonothecæ borne in the axils of the pinnæ, long, rather narrow, smooth, tapering about equally to the base and to the small circular aperture.

South Channel, Port Phillip Bay, Mr. Hy. Watts.

This species may be readily distinguished by the long slender stem, with its small branches arranged at short intervals from base to summit. These branches are mostly less than an inch long, and, in the specimens which I examined, were stouter and darker in the proximal portions, from which the pinnæ had fallen off. A single branch examined separately bears some resemblance to a shoot of *P. setaceoides*, but the hydrothecæ are more expanding, and differ also in being adnate up to the margin, and in the horizontal aperture. The fold or wrinkle which in *P. setaceoides* comes between the hydrotheca and the anterior sarcotheca is generally absent or slightly marked in the present species, and the sarcotheca is not so near the hydrotheca as in *P. setaceoides*, the internodes being longer.

#### PLUMULARIA OBLIQUA, *Saunders*, sp.

I have found branched specimens of this species on seaweed washed up on the beach at Williamstown.

#### PLUMULARIA PRODUCTA, *Bale*.

This species partakes of the characters of both the *Statoplea* and the *Eleutheroplea*. To the former group it is allied by the anterior position of the intrathecal ridge, a feature common to many *Statopleans*, while in those species of *Plumularia* which have a more or less distinct ridge it is posterior in position. The fixed anterior sarcotheca is not in contact with the calycle, and agrees generally with the same organ in many *Plumulariæ*, but the laterals, which are usually more distinctive, appear to be totally absent in this species. It should therefore probably be placed in a new



genus, which, however, cannot be satisfactorily defined at present, owing to the absence of the gonosome.

#### AGLAOPHENIA PARVULA, *Bale*.

The variation of the structure of the corbula in this species is paralleled by that of *A. filicula* (Allman), a closely-allied, but larger, species. Professor Allman thinks it probable that in *A. filicula* the closed corbula is the normal form, and that the occurrence of corbulæ with the leaflets separate is an occasional irregularity. Doubtless the open corbula, which in *A. parvula* is of comparatively rare occurrence, is a reversion to an ancestral type. The closed corbula of this species has a supernumerary rib or leaflet, as in *A. filicula*, but with the important difference that in the latter species it springs, like the other leaflets, from the rachis, while in *A. parvula* it is a secondary growth, given off from the first leaflet of the corbula just above the base, and almost at a right angle; it therefore runs forward about parallel with the rachis of the corbula. It is not present when the corbula is open.

#### AGLAOPHENIA DIVARICATA, *Busk*.

In *A. divaricata*, as well as in some other species, the proximal part of the branches is destitute of pinnæ for a distance about equal to the length of the pinnæ on the main stem, and this portion of the branch bears along the front a central series of sarcothecæ, which in *A. divaricata* are very large. The bare proximal part of the branch is separated from the remainder by a long oblique joint. Small unbranched specimens are generally monosiphonic throughout, the stem not assuming the compound state until the hydrophyton is considerably advanced in growth.

#### AGLAOPHENIA LONGICORNIS, *Busk*.

This species is rather variable in the form of the hydrotheca-margin, which is represented by Professor Allman as only slightly elevated and rounded at the sides, while Mr. Busk describes the hydrotheca as having on each side a broad angular lobe. Sometimes these lobes run up to an acute point. The margin is sub-crenate, but only towards the back, and there is a small tooth where the side joins the lateral sarcotheca, by which it is often concealed when the latter is erect. Between the lateral sarcothecæ the back of

the hydrotheca usually has two deep, narrow sinuses, with a long, narrow tooth between them, but they are sometimes comparatively shallow. The back of the hydrotheca can only be properly seen in front view when the hydrotheca is tilted forward. There is a deep inflection below the recurved aperture, not consolidated into an intrathecal ridge, but projecting so far into the hydrotheca that it is conspicuous in a front view, its inner margin having a bidentate form at the centre.

AGLAOPHENIA HUXLEYI, *Busk.*

In this species the hydrocladia are replaced at the distal ends of the branches by hollow spines without hydrothecæ, as first pointed out by Professor Allman, who has made the species the type of his new genus *Acanthocladium*. The figure of the hydrothecæ in the "Challenger" Report is erroneous in several particulars, noticeably in representing the margin as entire, while in reality it has a broad, rounded sinus at the back; in omitting the anterior tooth, which, though not large, is distinct and characteristic; and in showing the anterior sarcotheca as a long slender spine, closed throughout, whereas its true form is, in lateral view, remarkably beak-like, very stout where it joins the hydrotheca, and tapering rapidly upwards, with the point expanded laterally, while it is open on the distal side from base to summit. All these features are correctly characterised in Mr. Busk's original description, except that the open condition of the sarcotheca is not mentioned. This, however, is not apparent in an ordinary view, but on looking down on the hydrotheca from above it is easy to trace the opening down the sarcotheca, and to perceive that one of the margins overlaps the opposite one near the top. The expanded summit is usually, but not always, finely crenate. The crenations of the hydrotheca margin are much more pronounced in the "Challenger" figure than in any of the specimens which I have met with. The anterior intrathecal ridge attains its fullest development in this species, starting from the base of the mesial sarcotheca and projecting downward more than half-way through the hydrotheca, which it divides into two chambers. The posterior ridge is quite rudimentary.

Professor Allman has figured the corbula of this species, the ribs of which are curved filiform processes, armed with

a single series of small sarcothecæ. Each has a hydrotheca projecting from it near the base, these hydrothecæ constituting the "single branches" mentioned by Mr. Busk.

In the "Challenger" Report the branches of this species are described as being bifariously disposed on the stem; but this is an oversight, as, indeed, is made apparent by the figure, which shows them as given off in several different directions. Their disposition is very regular, and perfectly uniform in the specimens which I have seen from two different localities. The main stem is distinctly flexuous, and from each angle springs a branch. The branches, however, are not in the same plane, but are arranged spirally round the stem, so that every four branches form a complete whorl, there being thus three longitudinal series up the stem.

AGLAOPHENIA PHŒNICEA, Busk.

I have no doubt that the *Lytocarpus spectabilis* of the "Challenger" Report is identical with the type form of *Aglao phenia* (*Lytocarpus*) *phœnicea*, though the form figured in the Report is of stronger and coarser habit than any of my specimens. Professor Allman gives a figure of the gonangial pinna, or nematocladium, which agrees in essential points with the same part in a Port Darwin specimen, the only one which I have found fertile. The first internode bears a hydrotheca, the next a gonangium, and the remainder of the pinna is armed with sarcothecæ, and recurved over the rachis. As Professor Allman points out, the gonangium springs from an elevation of the internode, which has two lateral sarcothecæ on the distal side of it, and a median one in front. This elevation evidently represents a hydrotheca, to which it bears a considerable resemblance when seen in front view after the gonangium has been removed, the point of attachment representing the aperture of the hydrotheca. A peculiarity presents itself in my specimen which is not shown in Professor Allman's figure—namely, that the first sarcotheca above the gonangial internode, which is on the proximal side of the nematocladium, is unpaired, the space opposite it on the distal side being vacant, while all the other sarcothecæ to the end of the pinna are in pairs opposite each other.\*

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\* Several species of *Aglao phenia*, with open corbulæ, have the first and second sarcothecæ on the nematocladia unpaired, but in these the vacancies are on the proximal side—*A. divaricata*, *A. plumosa*, &c.

I have also observed that the hydrotheca which occupies the first internode of each nematocladium has one of its supracalycine sarcothecæ (that nearest the rachis) much smaller than the other, sometimes almost rudimentary. In the structure and position of the intrathecal ridge this species agrees with *A. Huxleyi*.

Though some of the forms which I have assigned to this species differ considerably from each other, I cannot find definite grounds for separating any of them unless the gonosomes should prove different. The remarkable variation in the direction of the lateral sarcothecæ must have presented itself in Mr. Busk's specimens, since he describes them as free and projecting, while in some of his sketches they are shown erect and adnate. The fact that they are frequently directed towards the back of the pinna no doubt accounts for the similar direction of those on the nematocladia, and it is to be observed that this backward direction obtains in the nematocladia of Professor Allman's specimens, and also in that from Port Darwin, though in each of these instances the supracalycine sarcothecæ are, for the most part, nearly erect and adnate.

The pinnately-disposed branches resemble those of *A. divaricata* in having the proximal part free from hydrocladia, and provided with a median series of sarcothecæ.

Kirchenpauer's *A. rostrata* is, I believe, the same as this species; also a Plumularian figured by Mr. Hincks in the *Popular Science Review* for July, 1874.

AGLAOPHENIA LENDENFELDI, *n. sp.*

(*A. Kirchenpauri*, Lend.)

I propose the above name for the species described by Dr. von Lendenfeld as *A. Kirchenpauri*, the latter name belonging properly to another species—the *Plumularia Kirchenpauri* of Heller (Zoophyten und Echinodermen des Adriatischen Meeres). The description of *A. Lendenfeldi*, with full illustrations, will be found in the Proceedings of the Linnean Society of New South Wales, Vol. IX., Part 3.

HALICORNARIA ASCIDIoidES, *Bale.*

I have omitted to mention in the "Catalogue" the locality in which this species was found—namely, Queenscliff.

HALICORNARIA FURCATA, *Bale*.

The remarks in the "Catalogue" respecting this species might lead to the supposition that the axillary hydrothecæ are borne directly on the stem, but this is not the case. Where the stem bifurcates a single hydrotheca usually projects from the axil, but it is supported by a true hydrocladium, which, however, consists of a single internode only.

HALICORNOPSIS AVICULARIS, *Kirch*.

*Azygoplone rostratum* of the "Challenger" Report is the same as the species which I have described under the above name, and I have no doubt of the specific identity of Kirchenpauer's *Aglaophenia avicularis*, though Professor Allman is not satisfied on this point, owing to an apparent difference in the mesial sarcotheca; a difference, however, which seems to me to depend merely on a slight inaccuracy in Kirchenpauer's figure, principally in making the sarcothecæ appear tubular. The interruption between the upper and lower parts of the sarcotheca is often much less conspicuous than in Allman's figure, and doubtless it was a specimen in this condition which was figured by Kirchenpauer (as also by myself in the "Catalogue").

I have erroneously described this species as monosiphonic, (an error into which Professor Allman has also fallen), it being in reality polysiphonic, as described by Kirchenpauer. The mistake is easily explained by the fact that the fascicled structure only extends to the lower part of the stem and the larger branches, so that all the smaller branches and the distal portions of the larger ones (and in young specimens, such as I had principally examined, the whole hydrophyton) are really monosiphonic. The species is, moreover, more closely allied to those which are monosiphonic in habit than to the ordinary fascicled forms, since the branches spring directly from the internodes of the stout jointed stem or larger branches, and not, as in those species, from the supplementary tubes which are added to them. Each branch has its origin at the side of the stem or larger branch, immediately opposite a hydrocladium.



## IV. REMARKS ON RECENT PUBLICATIONS.

THE AUSTRALIAN HYDROMEDUSÆ.—By R. von Lendenfeld, Ph.D. (from the Proceedings of the Linnean Society of New South Wales, Vols. IX. and X.).

Dr. von Lendenfeld's work is an important contribution to the history of the Australian Hydroida, containing a detailed system of classification, a list of previously-described species, with references and descriptions of many new species, most of which are illustrated by admirable figures. The life histories of some of the species have been worked out, and their histology carefully studied and illustrated.

The species cited or described in Dr. von Lendenfeld's work belong to a wider area of distribution than that which is represented in the "Catalogue of the Australian Hydroid Zoophytes." From the author's remark regarding a New Zealand species, to the effect that I appeared to doubt its habitat, as I had omitted it from the "Catalogue," it is evident that he has overlooked the remarks on distribution, which show that the Australian region, as represented in the "Catalogue," comprises only the continent and the seas immediately adjacent, not including New Zealand. Dr. von Lendenfeld, on the other hand, includes "within the Australian area the south coast of New Guinea, Fiji, New Zealand, Australia, and Tasmania, and the islands south-west of Fiji;" but in enumerating the species which have been described, he has omitted several which are found within these limits, and which are included in the following list:—

*Thuiaria monilifera*, Hutton, sp. *Sertularia monilifera*, Hut., T.N.Z.I., V.; Coughtrey, T.N.Z.I., VII.; D'A. W. Thompson, An. and Mag. Nat. Hist., Feb., '79; *Thuiaria cerastium*, Allman, Journ. Lin. Soc. Zool., XII. N. Zealand.

*Thuiaria subarticulata*, Coughtrey, T.N.Z.I., VII.; D'A. W. Thompson, An. and Mag. Nat. Hist., Feb., '79; *T. articulata*, Hutton, T.N.Z.I., V. (not Johnston); *T. bidens*, Allman, Journ. Lin. Soc. Zool., XII. N. Zealand.

*Thuiaria dolichocarpa*, Allman, Journ. Lin. Soc. Zool., XII.; D'A. W. Thompson, An. and Mag. Nat. Hist., Feb., '79; *T. Zelandica*, Gray, Dief., N.Z.; Quelch, An. and Mag. Nat. Hist., April, 1883. N. Zealand.

*Sertularella robusta*, Coughtrey, sp. *Sertularia simplex*, var. (?), Coughtrey, T.N.Z.I., VII.; *S. robusta*, Coughtrey, T.N.Z.I., VIII., An. and Mag. N.H., Jan. 1876. N. Zealand.

- Sertularella episcopus*, Allman, Journ. Lin. Soc. Zool., XII;  
*Sertularia fusiformis*, Hutton, T.N.Z.I., V.; Coughtrey,  
T.N.Z.I., VII.; *S. longicosta*, Coughtrey, T.N.Z.I., VIII.  
N. Zealand.
- Sertularella integra*, Allman, Journ. Lin. Soc. Zool., XII.  
N. Zealand.
- Sertularella exigua*, D'A.W.T., An. and Mag. N. Hist.,  
Feb., '79. N. Zealand.
- Sertularella fruticosa*, Esper, sp. *Sertularia fruticosa*,  
Esper, Hist. des Zooph. suppl.; *Sertularia laxa*, Lk.,  
An. s. Vert.; *Sertularella fruticosa*, D'A.W.T., An. and  
Mag. Nat. Hist., Feb., '79. N. Zealand.
- Selaginopsis Novæ-zelandiæ*, D'A.W.T. *Pericladium*  
*Novæ-zelandiæ*, D'A.W.T., An. and Mag. N. Hist., Feb.,  
1879. N. Zealand.
- Desmoscyphus Buskii*, Allman, Journ. Lin. Soc. Zool., XII.  
N. Zealand.
- Halecium delicatulum*, Coughtrey, An. and Mag. Nat. Hist.,  
January, 1876. N. Zealand.
- Hydrallmania* (?) *bicalycula*, Coughtrey, An. and Mag. Nat.  
Hist., Jan., 1876. N. Zealand.
- Aglaophenia Banksii*, Gray, sp. *Plumularia Banksii*, Gray,  
Dief. N.Z. N. Zealand.
- Aglaophenia Huttoni*, Coughtrey, sp. (not Kr.). *Plumu-*  
*laria Banksii*, Hutton, T.N.Z.I., Vol. V. (not Gray);  
*P. Huttoni*, Coughtrey, T.N.Z.I., VII. N. Zealand.
- Aglaophenia Huttoni*, Kirch. (not Coughtrey). *Plumularia*  
*pennatula*, Hutton, T.N.Z.I., V. (not Lamx). N. Zealand.
- Aglaophenia incisa*, Coughtrey, sp. *Plumularia incisa*, C.,  
T.N.Z.I., VII. N. Zealand.
- Aglaophenia acanthocarpa*, Allman, Journ. Lin. Soc. Zool.,  
XII. N. Zealand.
- Aglaophenia laxa*, Allman, Loc. cit. N. Zealand.
- Aglaophenia Vitiana*, Kirch. Hyd.-Fam. Plumularidæ (de-  
scription headed *Plumularia Vitiana* in error); *A.*  
*heterocarpa*, Bale, J.M.S.V., II. Fiji.
- Plumularia oligopyxis*, Kirch. Hyd.-Fam. Plumularidæ. Fiji.
- Several species more or less doubtful.

Of the foregoing species Dr. von Lendenfeld (following Kirchenpauer) includes in his third addendum *T. monilifera*, under the synonym of *T. cerastium* (Allman); and *T. subarticulata*, and its synonym *T. bidens*, as two species; the rest are not mentioned.

Besides the Hydroid Zoophytes which are included in the "Catalogue," Dr. von Lendenfeld's work comprises the Tracho-medusæ, or Monopsea\* of Allman, the graptolites, and the Hydrocorallinæ, the last of which are now ranked as a sub-order of Hydroida. (I may mention, however, that several Australian Hydromedusæ, which were described, and in some cases figured, by Péron and Lesueur, have been omitted from the list.) Dr. von Lendenfeld adopts the name Hydromedusæ for the whole order, but it seems to me that the term Hydroida is preferable, as some of the members of the order do not, at any period of their existence, develop a medusoid structure. The sub-orders are Hydropolypinæ, or Hydroid Zoophytes whose generative zooids are never of a medusoid nature; the Hydromedusinæ, which have gonophores more or less medusiform in structure; the Trachomedusinæ, which are medusæ without a fixed polyp-stage; and the Hydrocorallinæ, or calcareous Hydroid corals. The first two of these sub-orders are equivalent to Allman's Eleutheroblastea, Gymnoblastea, Calyptoblastea, and Rhabdophora. Dr. von Lendenfeld claims that the Hydroida should be classified, like all other organisms, according to the structure of the adult, or the stage of existence at which reproduction is effected, and likens a system of classification founded on the polyparies to a scheme in which the dried skins of the larvæ of *Cecidomya* should be taken as indicating its systematic position, irrespective of the structure of the adult insect. In the construction of genera, however, Allman and Hincks, as well as other recent writers, have given due consideration to the structure both of the reproductive zooids and the polype-forms, although their primary divisions may be open to the objection that they are founded partly on larval forms, and may have to be superseded accordingly. Mr. Hincks does not rank the Trachomedusæ even as a sub-order, since he finds that species which have a larval polyp-stage may, as regards the medusa, be absolutely identical in structure with forms in which the medusa is developed direct from the ovum.

Dr. von Lendenfeld includes in the sub-order Hydromedu-

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\* I have inadvertently stated in the "Catalogue" that nothing is known of the Australian members of this group. Not having occupied myself with them, I had overlooked the fact that Péron and Lesueur, Haeckel, and other writers have described several Australian species of the sub-order, as well as of those families which are supposed to pass through a larval polyp-stage, but whose development has not yet been traced.

sinæ all those hydroids which exhibit traces of a medusoid structure in the sexual zooids, following to some extent the classification of Weissman. The latter author, however, finding that in some genera the medusoid structure is present in the female gonozooids, but not in the male, and arguing from the evident alliance between the latter and those of many other hydroids, places these also in the medusoid group, and finally includes in the same section all the Calyptoblastic and Gymnoblastic genera, leaving Hydra as the only representative of the group to which Dr. von Lendenfeld has applied the name Hydropolypinæ. This is on the assumption that all forms which exhibit medusoid affinities, or which appear nearly allied to such forms, are descendants of older types which were, in the adult stage, free medusæ. Dr. von Lendenfeld dissents from this view, pointing out that as the polyp-form is a more primitive type than the medusa, the genera which exhibit no trace of the latter form, or some of them, are at least as likely to be direct descendants of those primitive organisms as to have retrograded from intermediate medusoid ancestors. This argument cannot be gainsaid, and it seems to justify Dr. von Lendenfeld in ranking under Hydropolypinæ all those genera in which no medusoid modification exists. But both Weissman and von Lendenfeld agree that in genera where the gonozooids are modified medusæ, the species are to be considered as the retrograded descendants of true medusa-bearing species. This appears to me to be an assumption for which the evidence is inadequate, for it is quite possible that some of these species may be in process of gradual development *towards* the medusoid form, or arrested at particular stages of such a process, rather than retrograding from a more specialised condition.

Although it may be conceded that the sub-orders Hydropolypinæ and Hydromedusinæ are truly natural groups, the fact that in some genera it is difficult to decide whether the gonozooids have medusoid affinities or not is an obstacle to the general use of such a classification, at least until our knowledge of the histology of the various genera shall be more complete.

As already mentioned, a number of species have to be added to Dr. von Lendenfeld's list, and a few have to be deleted—for example, *Halicornopsis rostratum*, which is the same as *H. avicularis*, and *Selaginopsis mirabilis*, which has evidently been added to the list under a misapprehension.

A RECORD OF LOCALITIES OF SOME NEW SOUTH WALES ZOOPHYTES, AS DETERMINED BY DR. KIRCHENPAUER, communicated by Baron F. von Mueller, K.C.M.G., &c. Proceedings of the Linnean Society of New South Wales, Vol. IX., Part 3, November, 1884.

This is a list of a few species of Hydroids and Bryozoa sent to Europe by Baron von Mueller and named by Dr. Kirchenpauer. The species of hydroids are named as follows:—

*Sertularella simplex*, Hutton.—The species examined by Kirchenpauer is not the same as Hutton's, as is evident from the fact that in his last work Kirchenpauer includes it among the species with transversely wrinkled hydrothecæ, while Hutton's original species is smooth, and is, as I have elsewhere pointed out, identical with *S. polyzonias*. There is, however, a rugose species, originally described by Coughtrey as a variety of *S. simplex*, and afterwards named *S. robusta* by the same author, and this, or some similar species, is probably the one seen by Dr. Kirchenpauer.

*Sertularella Johnstoni*, Gray.

*Sertularia lycopodium*, Lamarck.—This specific name is merely a synonym of *S. elongata* (Lamouroux).

*Sertularia millefolium*, Lamarck.—This is supposed to be a synonym of *S. scandens* (Lamouroux), but it is impossible to identify the species with certainty from the description of either author. Both descriptions agree perfectly, so far as they go, with the small variety of *S. elongata*, and not with any other species known to me, but the specimens examined by Kirchenpauer may possibly belong to some other form.

*Thuiaria cartilaginea*, n. sp.—Described in Kirchenpauer's later paper.

*Aglaophenia ramosa*, Busk.—As I have mentioned in the "Catalogue," the species identified by Kirchenpauer with Busk's *P. ramosa* is really the *P. divaricata* of the same author.

NORDISCHE GATTUNGEN UND ARTEN VON SERTULARIDEN VON DR. KIRCHENPAUER IN HAMBURG. Abhandlungen des Naturwissenschaftlichen Vereins in Hamburg, Band VIII., Abth. I., 1884.

This paper deals with the genera *Selaginopsis*, *Thuiaria*, and *Sertularella*, and with a group of species of which



*Sertularia abietina* and *S. filicula* are the types, which group the author proposes to separate as a distinct genus under the name of *Abietinaria*. There appear, however, to be no very definite grounds for this distinction, and on equally good foundations the genus *Sertularia* might be divided into fully half-a-dozen genera.

Among the species of *Thuiaria* and *Sertularella* a number from Australia are mentioned, several of which are described as new. I subjoin a few notes regarding some of them.

*Thuiaria lichenastrum*, Pallas, sp.—A form which occurs in a number of widely-separated localities, including Australia and Kamschatka, is referred to the above species by Kirchenpauer, who considers it perhaps synonymous with Busk's *Sertularia crisioides* (but not with the *Dynamena crisioides* of Lamouroux.) Busk's species, however (which I have described in the "Catalogue" under the name of *T. fenestrata*), is not the same as the present form, from which it may be readily distinguished by the vertical apertures of the hydrothecæ, and the four-toothed margin of the gonangium.

*Thuiaria cartilaginea*, K.—This species seems to resemble *T. lata* in some respects, but is peculiar in the absence of hydrothecæ from the stem and branches.

*Sertularella reticulata*, K.—A tricuspidate species from Bass' Straits, differing from *S. Johnstoni* in being inconspicuously toothed, and in the peculiar habit. It is dichotomously branched, with the branches all in the same plane, and often anastomosing, so as to form a net.

*Sertularella sub-dichotoma*, K.—A species from Bass' Straits and Magellan's Straits, described as differing from *S. Johnstoni* in its habit, which is not pinnate, but irregularly dichotomous. Busk's *S. divaricata* comes from the same localities as the above, but, though rather straggling, it is distinctly pinnate, and cannot therefore be identical with this species if Kirchenpauer's description is accurate.

*Sertularella infracta*, K.—This species, of which no figure is given, is said to differ from *S. Johnstoni* chiefly in its strong and robust habit, and in the form of the gonothecæ, which are "pear-shaped, short, thick, strongly inflated, and deeply ringed." The hydrothecæ are bent outward about the middle of their length. This feature, however, is not at all uncommon in *S. Johnstoni* and *S. divaricata*, the latter of which answers well to the description of *S. infracta*, and is very likely identical with it.

*Sertularella purpurea*, K.—This species (from the Chatham Islands) seems to me to differ little, if at all, from the ordinary New Zealand form of *S. Johnstoni*. Some of my specimens of the latter form agree with Kirchenpauer's in being of a beautiful purple-red throughout, but other parts of the same material are of the ordinary yellowish-brown colour, showing that the red tint is not a specific feature. I have met with the same variation of colouring in *Plumularia Buskii*, and Johnston mentions its occasional occurrence in some of the British Sertularians.

ON *THUIARIA ZELANDICA*, GRAY. By J. J. Quelch, B.Sc. (Lond.), Assistant Zoological Department, British Museum (Annals and Magazine of Natural History, April, 1883).

The author of the above paper has ascertained from an examination of some of Gray's specimens of *Thuiaria zelandica* that the *T. dolichocarpa* of Allman is the same species, and proposes to abolish the latter name in favour of the older one, in which he has been followed by Kirchenpauer. To admit the claim of priority in such a case as this, however, would be to ignore the first principle of scientific nomenclature, which requires that for a specific name to obtain acceptance it must be accompanied by a description at least sufficient for the identification of the species with a reasonable degree of certainty. Gray's definition is entirely worthless, hence the species should continue to bear the name bestowed upon it by Professor Allman, who first gave a proper description of it, accompanied by careful figures. On the same principle Mr. Hincks retains the name of *Campanulina acuminata* (Alder) for a species which had been found to be identical with the earlier *C. tenuis* (Van Beneden), on the ground that Van Beneden's description was not sufficient to enable the species to be recognised.

It appears to me that the laws of nomenclature can only be properly appealed to in order to decide which of two or more proposed names has the better claim to acceptance, and not to interfere with names which have already become generally adopted. On the opposite plan we should be obliged, for example, to abolish the universally received *Halicornaria* of Allman in favour of Hincks' name, *Gymnangium*, applied previously to the same group.

DESCRIPTION OF AUSTRALIAN, CAPE, AND OTHER HYDROIDA, MOSTLY NEW, FROM THE COLLECTION OF MISS H. GATTY, BY PROFESSOR ALLMAN.

(Journal of the Linnean Society, 1885.)

The above paper (which was only received here after the completion of the foregoing observations) contains descriptions and figures of many new species from various parts of the world, including two for which Professor Allman has established new genera. Of one of these genera, *Gattya*, I have inserted a notice in its proper place among the Eleutheroptera; the other, *Thecocladium*, belongs to the Sertulariidae, and is distinguished from *Thuiaria* by the fact that its branches spring from within hydrothecæ.

The Australian Hydroids which Professor Allman describes are for the most part new, but a few known forms are re-described and figured. I append notes on two or three of the species:—

*Sertularella trochocarpa*, n. sp.—This species appears in some respects intermediate between *Sertularia* and *Sertularella*, if an important feature of the latter genus be, as I have always considered it, the presence of a single hydrotheca only on each internode of the ramuli, instead of one or more pairs, as in *Sertularia*, or two unpaired series, as in *Thuiaria*. *S. trochocarpa* has two hydrothecæ on each internode, which are distinctly alternate; its general aspect is that of a *Sertularella*, and the gonothecæ are ringed and provided with a funnel-shaped mouth, as in some varieties of *S. Johnstoni* and its allies. Two Australian species of *Sertularia* have the gonothecæ ringed, but in these cases the summit is neither funnel-shaped nor toothed.

In all the species of *Sertularella* which have been hitherto well known and fully described, there is a single hydrotheca on each internode, except in the principal stems of some of the branched species.

*Sertularia minima*, Thompson.—From the relative position of the teeth of the hydrotheca in Professor Allman's figure it would appear to represent the back of the polypary. This would account also for the calyces not being shown in contact with each other, which is almost invariably their actual condition in the front of the polypary, except in the lowest pair or two.

The adnate condition of the opposite hydrothecæ would bring this species, as well as most of our other *Sertulariæ*,

under the genus *Desmoscyphus* of Allman; but I have not been able to adopt this genus, owing to the inconstancy of the characteristic feature. In some of the species it is present, while in others most closely allied to them it is wanting; and there are several species which vary in this respect in different specimens. Very often the hydrothecæ at the distal part of a branch are adnate to each other, while those in the proximal portion are separated.

In describing this species (as well as *S. minuta*) I have fallen into a slight inaccuracy as regards the position of the gonangia, which spring from the basal part of the lowest internode, but from the side of it rather than behind, as stated in the "Catalogue."

*Lytocarpus ramosus*, n. sp.—This species would come under the genus *Aglaophenia*, as defined in the foregoing pages, and it appears scarcely distinct from *A. divaricata*, a somewhat variable species. The corbula is like those of *A. plumosa* (Bale) and *A. acanthocarpa* (Allman) in every essential point; but in those species the "ribs" are slightly flattened and less arched.

The specific name *ramosa* is preoccupied by the *Plumularia ramosa* of Busk, a species closely resembling the present both in the trophosome and the gonosome. There is also an *Aglaophenia ramosa*, the gonosome of which is unknown, among Allman's Gulf Stream Hydroids.

*Plumularia ramosa* (Busk), *P. divaricata* (Busk), and *Lytocarpus ramosus* (Allman) are all found in or near Bass' Straits, and it is not unlikely that on future investigation they may all prove to be varieties of one species.

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